

project WEB

spring
1999

Connecting Projects WILD, WET and Learning Tree in New Hampshire

EXPLORING BIODIVERSITY

AS EARTH SEEMS TO AWAKEN with the coming of spring, it is time to reflect upon the great diversity of life from the one-celled algae and bacteria to the majestic moose. New Hampshire is blessed with a wide variety of organisms and the natural communities in which they live. We can see the process and interactions that weave themselves into a complex web, right outside our doors.

This diversity or variety and variability of living organisms is often referred to as biological diversity or biodiversity. Biodiversity

is what makes our lives possible – no matter where we live or who we are.

What better time than right now to begin exploring the biodiversity inside your classroom and just outside the door. Our lives are utterly dependent on the global web of life; isn't it important for us to understand it?

This issue of Project WEB focuses on biodiversity, what it is and ways to explore it. You will find suggestions for resources and activities for your students. Enjoy the spring and open your eyes, ears and heart to the great diversity of life.

Congratulations!



THE PROJECT WEB newsletter would like to announce the arrival of the newest (and youngest) member of the PLT family, Grace Carolyn, daughter of our NH Project Learning Tree Coordinator, Esther Cowles, and her husband, Peter. Grace was born on Monday, March 29, 1999. The entire WET, WILD and PLT network in New Hampshire wishes them the best.

LIFE SPRINGS IN VERNAL POOLS

ONE OF THE GREATEST SOUNDS OF SPRING is the distinctive chorus of thousands of spring peepers calling in the early twilight hours. Spring peepers have been known to call so loudly that motorists passing near ponds and marshes have heard them through closed windows. Their call has even been mistaken for the sound of sleigh bells in the distance.

Before we can teach children, we have to give them a reason for learning: the reason being to become part of the world; thinking of it together rather than in pieces.

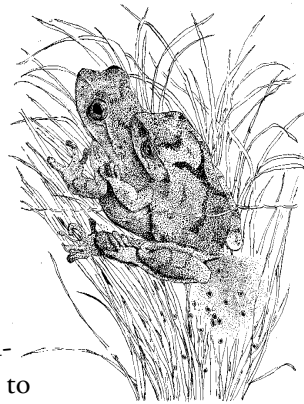
-Aldo Leopold



Spring peepers are only one of a myriad of organisms that sometimes use a specialized type of

wetland, known as a vernal pool, for their spring-time breeding events. Vernal pools represent one type of biological community, contributing to the habitat diversity of New Hampshire. Their appearance varies from place to place because of the diversity of climate, soils, and vegetation.

A vernal pool is a contained basin depression that lacks a permanent above ground outlet. In the Northeast, it fills with water with the rising water table of fall and



spring peepers

VERNAL POOLS continued on page 6



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Fish & Game
Department

BIOLOGICAL DIVERSITY?

What is

BIODIVERSITY IS THE VARIETY and variability of all living organisms.

Species diversity is the most easily understood and commonly used measure of biodiversity. A species is a group of individuals capable of breeding with each other, but unable to breed successfully with any other group. In New Hampshire, more than 15,000 different species have been identified, ranging from rare (Karner blue butterflies, cobblestone tiger beetles, lynx, and squirrel corn) to common (American robins, black flies, white-tailed deer, and sugar maples). In New Hampshire there are 11,000 known insect species and nearly 3,000 species of flowering plants, ferns, fungi, algae, bryophytes, and lichens.

Genetic diversity refers to variation in genetic makeup among individuals of the same species. Genetic diversity occurs within populations. For example, individual trees in a stand of pitch pine may be genetically different from each other. Variation within the gene pool increases the chance that a species will adapt to changing environmental conditions. A species that is rare in New Hampshire, yet common elsewhere, may be an important element of the region's biodiversity,

since populations in New Hampshire may be genetically distinct from other populations.

Biologically, a community is a group of species (plants, animals, fungi, microorganisms) that occur together in a particular area. Alpine bogs, spruce-fir forests, Atlantic white cedar swamps and coastal sand dunes are examples of the 130 types of biological communities identified in

New Hampshire. These different communities represent habitat diversity. An ecosystem is a community or group of


communities, plus their physical environment (soils, geology, climate, etc.) Different communities or ecosystems contain different species and often differ in the processes that occur within them.

Change within these levels of biodiversity is constantly occurring at different scales of time and space. Natural and human-induced change in biodiversity is inevitable. Factors that bring about change in biological diversity range from local disturbance, such as a tree fall, to shifts in global climatic conditions.

Factors Affecting Biodiversity in New Hampshire

Some places have greater biological diversity than others. Costa Rica has more species of birds than New

Hampshire. A New Hampshire northern hardwood forest has more species than a spruce-fir forest. The White Mountains have more plant and animal communities than the hills of Cheshire County.

For over a century, ecologists have sought to explain such patterns of biological diversity. Research indicates that diversity is affected by many factors interacting in complex ways. The physical environment has a great influence on biological diversity. Ecological processes such as disturbance, population growth, predation and dispersal interact with the physical environment to affect biological diversity. In addition, human activities often have dramatic effects on the processes that determine biological diversity 

(Excerpted from New Hampshire's Living Legacy - The Biodiversity of the Granite State, Edited by James Taylor, Thomas Lee, and Laura Falk McCarthy, New Hampshire Fish and Game Department).

SOME RARE COMMUNITIES OF NEW HAMPSHIRE

- ALPINE
- COASTAL PLAIN POND SHORES AND BASIN MARSHES
- ALPINE BOGS AND BOREAL SLOPING FENS
- CALCAREOUS FENS AND RIVERSIDE SEEPS
- ATLANTIC WHITE CEDAR SWAMPS
- ENRICHED HARDWOOD FORESTS
- BLACK GUM SWAMPS
- FLOODPLAIN FORESTS
- PITCH PINE-SCRUB OAK WOODLANDS

Natural Communities of New Hampshire

The natural communities of New Hampshire can be grouped within five climate-related vegetation types whose plants have similar distribution in North America.



ALPINE AND SUBALPINE - Restricted to high elevations and ravines in the White Mountain subsection.



SPRUCE-FIR NORTHERN HARDWOOD - Dominated by red spruce, balsam fir, sugar maple, yellow birch and American beech in the White Mountains and New Hampshire-Vermont upland sections at mid to high elevations.



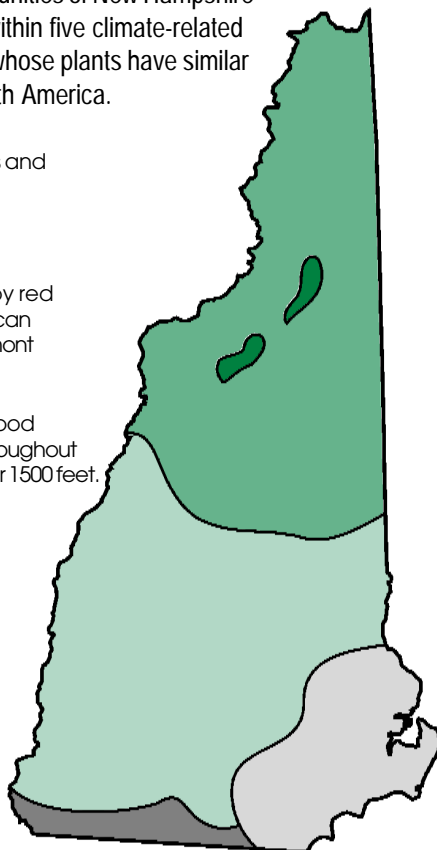
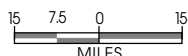
TRANSITIONAL FOREST - Northern and central hardwood species as well as white pine and hemlock, are found throughout the state and in the White Mountains at elevations under 1500 feet.



CENTRAL HARDWOOD FORESTS - Oaks, hickories, flowering dogwood, sassafras and other plant species found in the Appalachian states.



COASTAL PLAIN - Overlaps with the central hardwood, includes many wetland types such as Atlantic white cedar swamp.



SEE YOU NEXT FALL

The coordinators of Projects WET, WILD, and Learning Tree wish you all a happy and safe summer vacation! We will also be taking a vacation from publishing the PROJECT WEB NEWSLETTER over the summer. Look for your next issue to arrive in the fall.



Calendar of Events

June 26 GETTING TO KNOW: AMERICAN PIPITS, 9:00 am - 3:00 pm, Pinkham Notch Visitors Center. Cost: \$36 (AMC members) and \$40 (non-members). For more information contact AMC at 466-2727.

June 26 - July 1 Participate in the **GREAT AMERICAN SECCHI DIP-IN** by taking a water clarity measurement from a local lake, using a secchi disk. Disks can be borrowed from NHDES and most local colleges or universities. For more information visit <http://humboldt.kent.edu/~dipin>

July 7-24 OPERATION PATHFINDER, a national, graduate-level marine education and oceanography course for teachers, held at the University of NH, in Durham. Materials, food, lodging, most travel expenses, and a \$300 stipend are provided. For more information contact UNH Sea Grant at 749-1565.

August 3-6 and 9-13 (9 days) WATERSHED ECOLOGY COURSE sponsored by the Environmental Education Institute. Topics to be covered include watersheds; the ecology of lake, stream, wetland, estuarine and marine systems; groundwater; forestry; and wildlife. The course is being held at Exeter High School, Room V209, each day from 8:30 am to 3:45 pm. Cost is \$200 if taken for no-credit, \$332 is taken for two undergraduate credits (NH resident), and \$386 if taken for two graduate credits (N.H. resident). For more information, contact UNH Cooperative Extension at 862-1029.

August 14 CELEBRATE YOUR LAKES DAY - Winnepesaukee, Heskyl Park, Meredith, NH, 11 am-3 pm. Contact the Lake Winnepesaukee Watershed Partnership at 528-8703 for more information.

August 15 CELEBRATE YOUR LAKES DAY - Sunapee, Lake Sunapee Harbor, Sunapee, NH, 10am-2 pm. Contact the Lake Sunapee Protective Association at 763-2210.

September 18 COASTAL CLEAN-UP DAY. For more information contact Cynthia Lay at 431-9366.

September 25 NATIONAL PUBLIC LANDS DAY, for more info contact pride@neetf.org

October 1-3 NEW ENGLAND ENVIRONMENTAL EDUCATION ALLIANCE ANNUAL CONFERENCE at the Grossman Leadership Center in Cape Cod, MA. For more information contact Kim Noyes at 413-659-4462 or by e-mail at noyesgk@nu.com

Why Trees GROW Where They Do

New Hampshire's forests are more diverse than almost any others in North America. These forests host 74 native tree species, 12 softwood and 62 hardwood species. Some of these tree communities cover large expanses, while others exist in smaller amounts. Foresters and others classify forests into broad regions known as forest cover types, each named for the primary tree species it contains. There are three primary forest cover types in our state: spruce and fir forest, northern hardwood forest and oak and pine forest.

Why do the trees grow where they do? Geology, soils, water, and climate have much to do with it. Part of the answer to the question starts with the last ice age. Glaciers that covered our state about 10,000 to 15,000 years ago carved out the land and manipulated its contours. Soils and rocks moved with the

advancement of the shield of ice. Mountains were rounded and bedrock uncovered. Rocks were broken and buried. As the ice age ended and the glacier melted, soils made of rocks, sands, silts and clays settled, creating the varied anatomy of the landscape.

Soil deposited by moving ice is called till and that by water flowing from the ice is called outwash. Till is a mixture of rock particle sizes ranging from those too small to be seen by the unaided eye to boulders several meters across. Outwash soils tend to be more coarse, made up mostly of sand and gravel. These different particle sizes resulted from the different types of bedrock from which they came. Softer types of bedrock resulted in large amounts of clay deposits while harder types, like granite, produced sand and gravel.

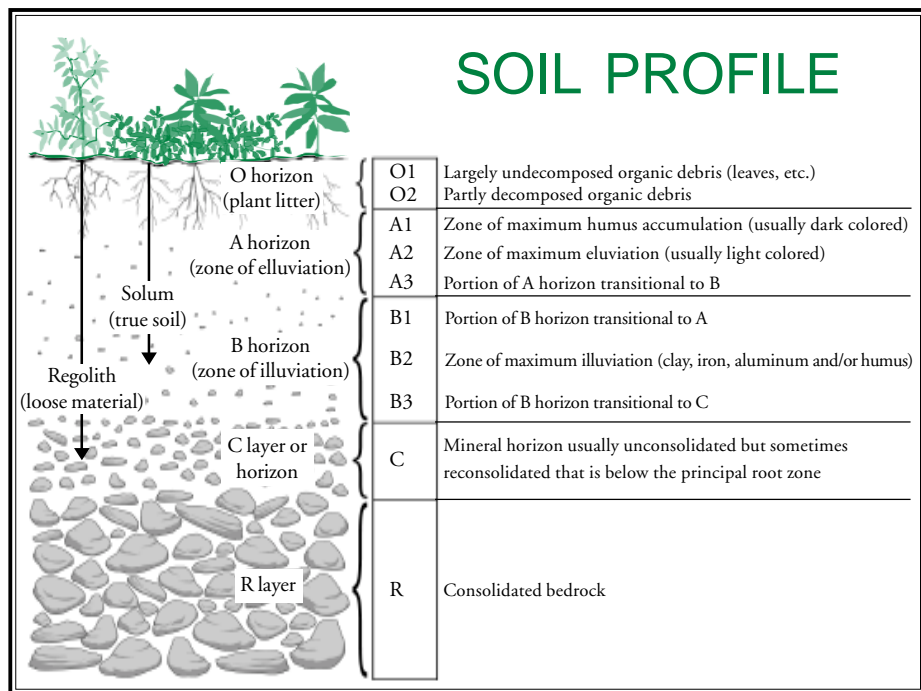
Although New Hampshire is known as the Granite State, other types of rock are found here. In the southeastern area, metamorphic bedrock of mostly schist and gneiss exists. The southwestern part of the state has metamorphic bedrock made of phyllite and schist. Mostly granite and schist are located in the White Mountains region. Above this, in the

Mahoosuc-Rangeley Lakes and Connecticut Lakes region, the bedrock is more complex. Here phyllite, slate and granite are intermixed. All of these different bedrock types helped establish different soil conditions around the state as a result of glaciation. These soils govern the amount of water and nutrient content available, based on the characteristics of particle size, how compacted the particles are and the amount of organic matter present.

As soil accumulates in an area over the bedrock foundation, it sets up a pattern or profile. In a forest, this profile begins with the top layer, covered with twigs and leaves known as litter, followed by the humus layer, consisting of black organic matter formed by decaying litter. Beneath this, the soil is comprised of three layers, known as horizons A, B, and C. Depending on the topography and the effects of wind and water erosion, these three horizon layers vary in depth.

The U. S. Forest Service's brochure, "Why Trees Grow Where They Do," explains that, when identifying tree habitats in New Hampshire, the most important layers in the profile are B and C. In the B horizon, water content (dry, moist, or wet) and soil enrichment (enriched or nonenriched) are important factors. In the C horizon, particle size (rocks, gravel and sand, or silt and clay) and compaction (compacted or noncompacted) are the important characteristics. From these characteristics, nine basic habitat types have been identified for New Hampshire forests. Each of these nine habitats supports communities of trees that have adaptations for growing in those conditions.

While geology, soils and water are strong controlling factors determining tree habitats, climate also plays a significant role in where trees grow. Anyone living in



New Hampshire knows the variability of temperatures and rainfall experienced here. The macroclimate data gives an average temperature of 22°C (70°F) for July and 4°C (25°F) to 14°C (36°F) for January, inland being colder than the coast. Temperatures fluctuate much more widely than this, depending on latitude, elevation and proximity to the ocean. Average rainfall is reported as 100 centimeters (40 inches) annually. In a wet year, over 170 centimeters (65 inches) of precipitation may fall and in a dry year as little as 60 centimeters (23 inches).

With this climatic mix, New Hampshire is truly a place where north meets south. Some species of trees are at the northern-most limit of their range, such as sycamore and black oak. Other species are at their southern-most point, such as larch (except in bog habitats). These diverse forests provide rich habitat that helps support the many unique communities throughout our state. ⚡

FOREST COVER TYPES

THOUGH FORESTS ARE NATURAL COMMUNITIES, foresters and others also classify forests into broad regions called *forest cover types*. Most of New Hampshire's forest land can be found within three forest cover types, each named for its primary tree species.

The Spruce and Fir Forest

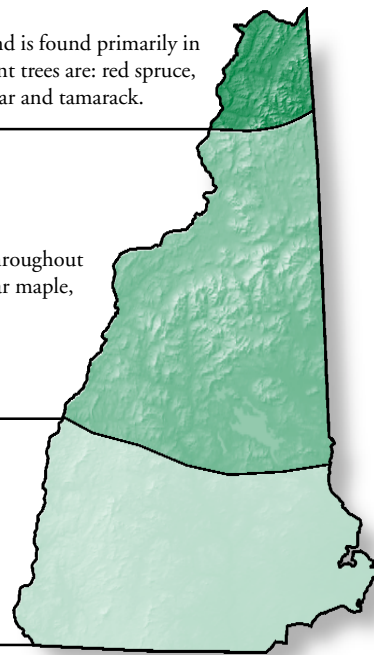
This type encompasses 14% of the forest land and is found primarily in the state's northern three counties. The Dominant trees are: red spruce, white spruce, black spruce, balsam fir, white cedar and tamarack.

The Northern Hardwood Forest

This type encompasses 42% of the forest land throughout the state. The primary trees in this type are: sugar maple, beech, yellow birch, and some red maple.

The Oak and Pine Forest

This type encompasses much of the remaining 44% of forest land, and grows mostly in the southern part of the state. The primary trees are: red oak, red maple, hemlock, white pine, and some red pine.



Activities Related to Articles in This Issue

Project WET suggests:

In *Life in the Fast Lane*, students collect data on a temporary wetland and then role play to understand the benefits and challenges of organisms that live in temporary wetlands.

Macroinvertebrate Mayhem helps students understand how biologists use the diversity of aquatic invertebrates in a stream to determine the health of that water body and how that diversity may be reduced when an environmental stressor is introduced.

In *Water Address*, students identify plants and animals and their habitats by analyzing clues that describe the water-related adaptations of the organisms.

Salt Marsh Players helps students recognize how organisms adapt to life in a salt marsh and the zonation that occurs from the flooding and draining of the tides.

Project Learning Tree suggests:

Planet of Plenty allows students to investigate the diversity of plants and animals on a small plot of land and to explain the importance of diversity in an ecosystem.

Charting Diversity explores the amazing diversity of life on earth allowing students to discover how plants and animals are adapted for survival and why there are so many species.

In *Rain Seasons*, students design experiments to see how climatic factors influence the growth and lives of plants.

Field, Forest and Stream allows students to investigate three different environments as they focus on sunlight, soil moisture, temperature, wind, plants, and animals of each environment.

Project WILD suggests:

Pond Succession helps students recognize that natural environments are involved in a process of continual change.

What Bear Goes Where? asks students to match three species of bear and their habitats to understand that animals are adapted to live where they do.

Project WILD Aquatic suggests:

Blue Ribbon Niche has students identify different organisms that live in riparian ecosystems, identify the ecological role of organisms and evaluate potential positive and negative effects from changes in riparian habitats.

In *Marsh Munchers*, students identify a food web in a salt marsh.

VERNAL POOLS *continued from page 1*
 winter or with the meltwater and runoff of winter and spring snow and rain. Vernal pools often contain water for only a few months in the spring and fall and are usually dry during the summer. Their name comes from the Latin word for spring.

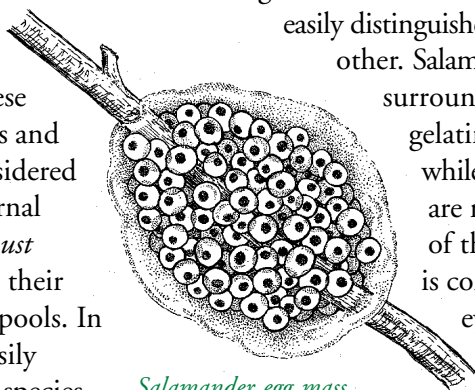
To be considered a true vernal pool, a temporary wetland must provide essential breeding habitat for certain amphibians and invertebrates. These particular amphibians and invertebrates are considered obligate species of vernal pools because they *must* either breed or spend their whole lives in vernal pools. In New England, the easily recognizable obligate species are the wood frog and the mole salamanders (spotted, blue-spotted, Jefferson, and marbled salamanders), who only come to a vernal pool during their springtime breeding season, and fairy shrimp, who spend their entire lives in the pool and die when it drains. While these organisms face a race against time to complete development before the pool dries, they also benefit from the absence of predatory fish.

Other species that are commonly found in vernal pools, but which are not dependent upon them, are considered facultative species. Common facultative species of vernal pools in New Hampshire include spotted turtles, caddisflies, fingernail clams, and our friends, the spring peepers, among others.

Mole salamanders and wood frogs, which depend upon vernal pools as breeding grounds, usually migrate from their upland forest homes to the pools once certain conditions are met. For instance, the ground must be thawed, the temperature must be in the high 40s (F), and it must be a rainy evening. The first night which

meets all these conditions is sometimes referred to as the “Big Night” and may result in numerous salamanders and wood frogs making their way to vernal pools.

Once these amphibians have mated, the female leaves a mass of eggs in the pool, usually attached to vegetation. The egg masses of wood frogs and mole salamanders can be easily distinguished from each other. Salamander eggs are surrounded by a



Salamander egg mass

gelatinous envelope while wood frog eggs are not. Discovery of these egg masses is considered evidence that the wetland is a vernal pool, because it means

that wood frogs or mole salamanders were previously there. The eggs will eventually hatch, and the race will be on for the young to sufficiently develop so they may leave the pool and venture to upland habitat. Eventually they will return to the pool to breed.

Fairy shrimp are small crustaceans that spend their entire lives in vernal pools. They are fairly abundant in pools during the late winter and early spring, when mating occurs. After breeding, the adults live only as long as there is water in the pool.

The fertilized eggs remain attached to a parent until it dies, at which point they are released and remain on the pool bottom. These resting eggs will endure extreme conditions such as drying, heating, and freezing, until reflooding the following spring stimulates them to hatch.

If you are interested in studying vernal pools, or determining if a wetland near your school is a true vernal pool, here is a short-list of resources available to help you.

➡ *Identification of Vernal Pools in New Hampshire* is a resource guide available from the N.H. Fish and Game Department (\$6.95 + \$2.00 S&H). For an order form, contact NHF&G at 271-3422.

➡ One of the best websites for information on vernal pools is maintained by the VERNAL POOL ASSOCIATION OF READING HIGH SCHOOL and can be found at http://earth.simmons.edu/vernal/pool/vernal_1.htm. This site contains definitions, general information, pictures and graphics, references, and additional resources for investigating vernal pools with your school.

➡ We also suggest that you check with your LOCAL CONSERVATION COMMISSION to see if any previous work has been done on vernal pools in your town, which you and your students might build on. 💧

Did You Know?



Wetlands, such as vernal pools, are often incredibly rich in wildlife, partly because of the complexity of the habitat and partly because of the abundant nutrients provided by runoff from the land. *Wetlands are second only to rain forests in the amount of biodiversity they support!*

SCHOOLYARD HABITATS UPDATE

ON THE H.O.M.E. FRONT

GO NATIVE!

Maintaining Biodiversity in the Schoolyard

*Adapted from an article of the Metro
Forest Council, N.Y.*

ENHANCING SCHOOLGROUNDS for wildlife often involves plantings of some kind to provide essential food and cover. Choosing native plants supports natural biodiversity and maintains viable communities and resilience and stability in the landscape.

Every part of the world has its own native plants that grow together in complex natural communities. Here in the U.S., “natives” are generally thought of as those species existing here before the advent of Europeans, plants that evolved in North America with our climate and soil types. Plants imported to an area by human activity are called “exotics” and are not part of the local native flora.

Most of the exotic plants in our vicinity come from temperate regions in Europe and Asia, brought here by European settlers who carried medicinal herbs, plants to feed their livestock, and their favorite flowers. Some exotic plants have come accidentally as seeds in imported cargo; others have been brought in by farmers, botanists, and avid gardeners.

MOUNTAIN ASH -

*Fast growing
native tree,
providing
excellent
winter food
for wild
turkey, cedar
waxwing and
robins.*



When certain exotic plants move into native plant communities, they can cause severe ecological disturbances. We call these “invasive exotics.” Once introduced, these plants can grow and reproduce freely because the area lacks the insects and diseases that keep them under control in their native habitats. They often outcompete native plants. Some exotic species are so aggressive that they form monocultures, pure stands of single plant species.

New plants are constantly being introduced into our environment, but it is often years before we realize that a specific plant is a problem. However, many invasive plants share some characteristics: they often spread vegetatively by means of underground

stems; their seeds germinate easily; and they reach reproductive maturity quickly. Exotic plants with any of these qualities should be watched carefully.

How You Can Help

1. Check your schoolyard site for exotic plant problems.
2. Plant native species when possible, especially when planting near natural areas.
3. Avoid planting non-native species described as “good groundcover” or “vigorous grower”.
4. Volunteer at a park or woodland near you to help remove invasive plants.
5. Learn more about woodland management issues from organizations such as the Society for the Protection of NH Forests and UNH Cooperative Extension.
6. Join the New England Wildflower Society at Garden in the Woods.

For a list of native plants for wildlife, sources of native plants, or articles on invasive plants from the New England Wild Flower Society, contact Marilyn Wyzga at Project HOME 603/271-3211, mwyzga@wildlife.state.nh.us.

RECOMMENDED RESOURCES

Published Resources

Manual of Woody Landscape Plants.

M.A. Dirr; Stipes Publishing Co., Champaign, Ill. 1990

Manual of Vascular Plants of Northeastern United States and Adjacent Canada.

H.A. And A. Gleason; New York Botanical Garden, NY. 1991

Native Trees, Shrubs and Vines for Urban and Rural America.

G.L. Hightshoe; Van Nostrand Reinhold, NY. 1988

On-line Resources

The Nature Conservancy Exotic Species Element Stewardship Abstracts

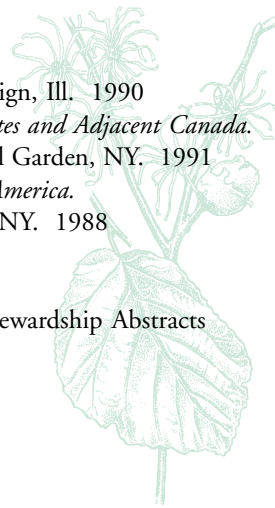
www.tnc.org/sciencelr/weeds/list.htm

National Plants Database

www.itis.usda.gov/

Natural Resources Conservation Service

plantmaterials.nrcs.usda.gov



ANNOUNCEMENTS

Project WET and State Standards

A new handbook is now available linking all 91 activities in the *Project WET Curriculum and Activity Guide to the NH Curriculum Frameworks*. For more information, please contact NH Project WET at 271-4071 or e-mail us at wet@des.state.nh.us

Water Quality Monitoring Opportunities for NH Educators

Two new flyers listing programs, curricula, and resources for water quality monitoring in New Hampshire are available from N.H. Department of Environmental Services. To receive these flyers contact Nicole Clegg (Project WET) at 271-4071 or Beth Malcolm (VRAP) at 271-2457.

Environmental Education Fact Sheet Available

The NH Department of Environmental Services (NHDES) offers numerous environmental education and outreach programs/resources suitable for use by teachers and nonformal educators. To receive a fact sheet outlining these resources,

contact DES's Public Information and Permitting Office at 271-2975 and ask for Fact Sheet CO-9 entitled *Environmental Education Opportunities Available From the New Hampshire Department of Environmental Services*, or see it on the web at www.state.nh.us/des/co-9.htm.

EPA Region 1 - Environmental Teacher Resource Center

Visit EPA Region 1's newest resource at www.epa.gov/region1. Once there, click on Students/Teachers and view features on activity guides, grant opportunities, environmental education programs, summer internships, and contests and award programs.

Volunteer River Assessment Program

New Hampshire's river and stream ecosystems are an outdoor classroom waiting to be explored! Water quality monitoring can build a strong commitment to environmental stewardship among students and teachers, parents and the community at large. The Department of Environmental Services initiated the *Volunteer River Assessment Program*

(VRAP) to support and coordinate volunteer water quality monitoring of New Hampshire's rivers and streams by providing organizational assistance, study design aid, technical training and equipment loans. These services are available to groups, including schools, interested in monitoring water quality indicators to assess the health of aquatic ecosystems. For more information contact Beth Malcolm, VRAP coordinator. Call (603) 271-2457 or e-mail at b_malcolm@des.state.nh.us.

Updated Wild Resources Now Available

The New Hampshire Fish & Game Department resources for teachers list has been updated. *Wild Resources* provides a list of audio visual programs, teacher workshops and curriculum kits. It is available by callin 271-3211 or on the web at www.wildlife.state.nh.us.

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